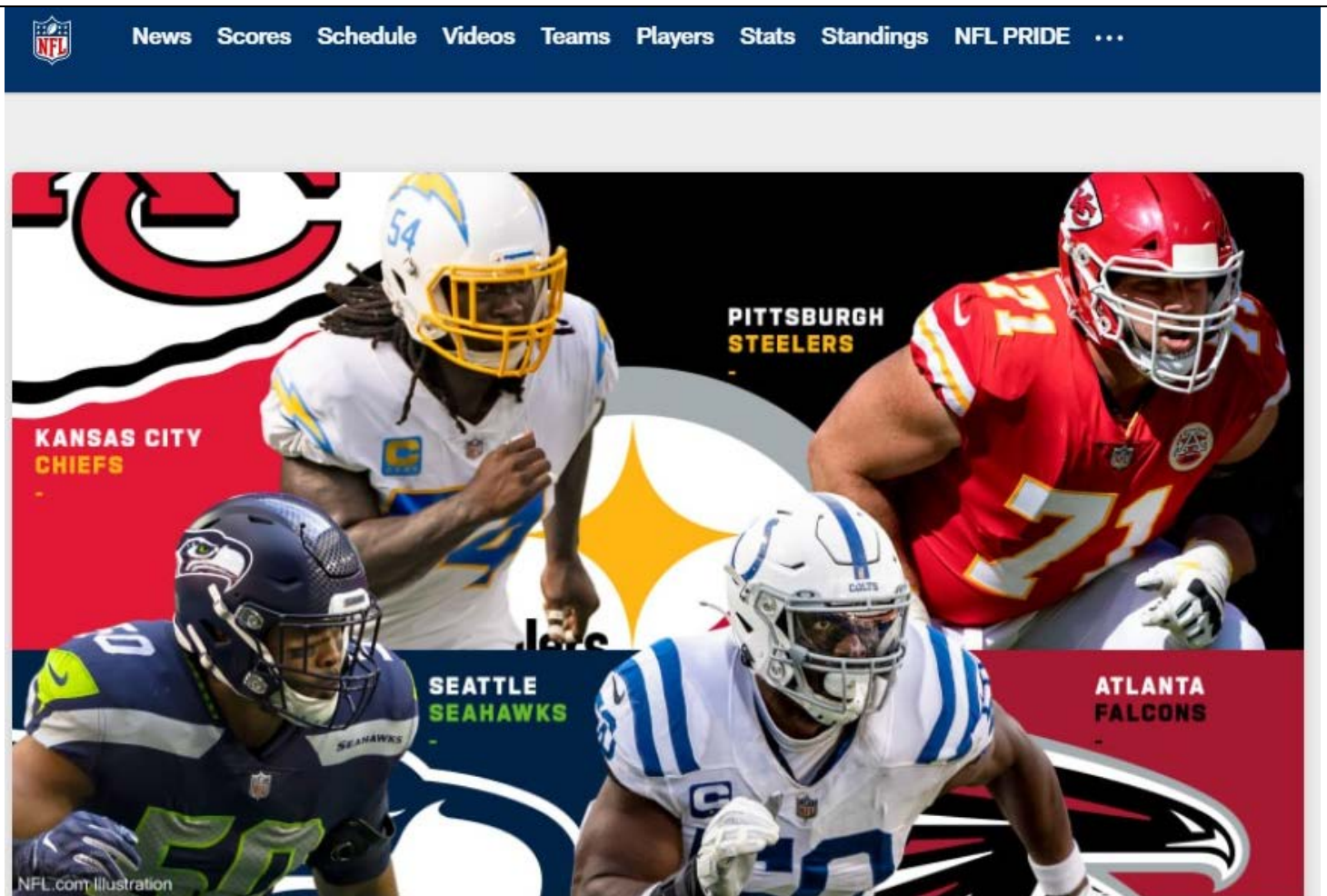
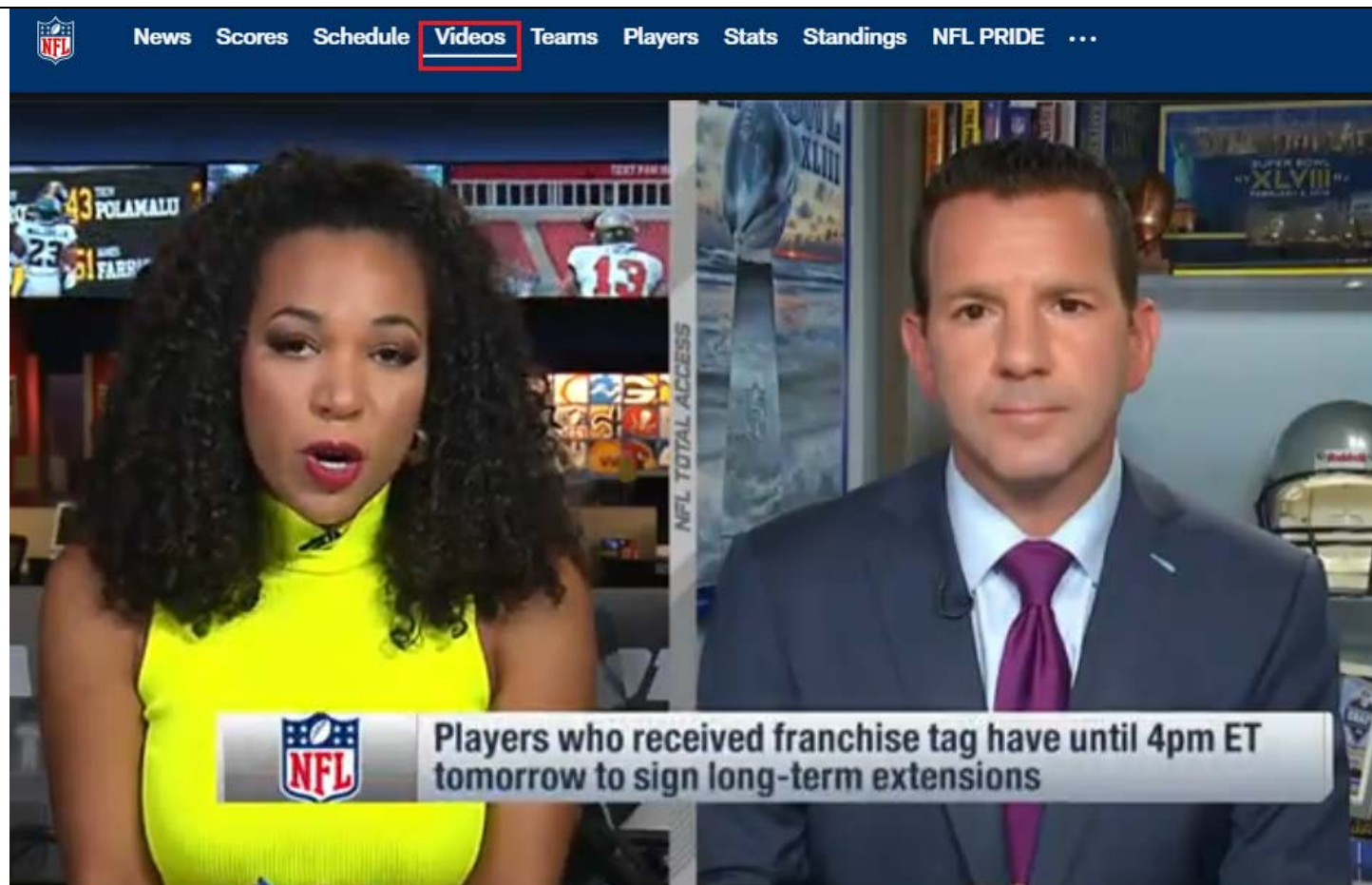


EXHIBIT C

| US7079752 | NFL.com |
|---|--|
| <p>1. A process for recording, on a recording medium, a scrambled digital video stream, implementing the following steps, in addition to the recording of the scrambled data:</p> | <p>NFL.com supports HLS streaming protocol (“the Standard”), including for delivery of contents to its customers/viewers, including in its internal testing and usage.</p> <p>On information and belief, Defendant performs all steps of claim 1 or, alternatively, to the extent a viewer performs any step, Defendant conditions the viewer’s use of the Defendant’s accused instrumentalities using the Standard on the performance of that step as disclosed herein. For example, on information and belief, a viewer cannot use the accused instrumentality utilizing the Standard as described in this claim chart without performance of the steps recited in this claim. By providing the accused instrumentality utilizing the Standard as disclosed herein, Defendant also controls the manner and/or timing of the functionality described in this claim chart. In other words, for a viewer to utilize the functionality described in this claim chart, the steps of this claim must be performed in the manner described herein. Without performance of the steps as described herein, the Defendant’s functionality will not be available to viewers.</p> <p>As shown below, video content from NFL.com is streamed and the data traffic is captured showing the media format (HLS), the m3u8 file (e.g., the Media playlist file comprising links to content chunks in .ts format used by HLS to contain information about the media playing), and the encryption scheme used by the streamed video. In addition, the HLS stream provided through NFL.com provides trick mode operation (such as 10 second reverse and forward trick modes) to the streamed video.</p> <p>The Standard practices a process for recording (e.g., recording by means of downloading in a storage), on a recording medium (e.g., a storage mechanism), a scrambled digital video stream (e.g., scrambled video created by making use of AES 128 bit encryption), implementing the following steps, in addition to the recording of the scrambled data.</p> |



<https://www.nfl.com/>



<https://www.nfl.com/videos/>

Shown below is the URL of a .m3u8 master file sent by the NFL.com server which identifies the usage of HLS based streaming by NFL.com servers. The .m3u8 master file refers to all the variants of the video encoded for various bandwidths and resolutions. The URL of the .m3u8 master file is: <https://dcs-vod.apis.anvato.net/vod/p/session/master.m3u8?i=i177471499-n91f2d446-9e01-448b-a085-4ea04cb8c83d&anvtrid=w5741a7f3ae79f3c1fe4d8caa729b689>, which will redirect to

<https://au5e6f8g7ryz8sqdsuw3dcdapdf.ctl.nfl.com> for content streaming.

The screenshot displays the Fiddler tool interface with the 'Headers' tab selected. The top toolbar includes buttons for 'Get Started', 'Statistics', 'Inspectors', 'AutoResponder', 'Composer', 'Fiddler Orchestra Beta', and 'FiddlerScript'. Below the toolbar, the 'Request Headers' section shows the following details:

- Request Headers:** GET /vod/p/session/master.m3u8?i=177471499-n91f2d446-9e01-448b-a085-4ea04cb8c83d&anvtrid=w5741a7f3ae79f3c1fe4d8caa729b689 HTTP/1.1
- Client:**
 - Accept: */*
 - Accept-Encoding: gzip, deflate, br
 - Accept-Language: en-US,en;q=0.9
 - User-Agent: Mozilla/5.0 (Windows NT 6.1; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/91.0.4472.124 Safari/537.36
- Miscellaneous:**
 - Referer: https://www.nfl.com/
- Security:**
 - Origin: https://www.nfl.com
 - sec-ch-ua: "Not;A Brand";v="99", "Google Chrome";v="91", "Chromium";v="91"
 - sec-ch-ua-mobile: ?0

The bottom section shows the 'Response Headers' tab with the following details:

- Response Headers:** HTTP/1.1 200 OK
- Cache:**
 - Cache-Control: max-age=0, no-cache, no-store
 - Date: Thu, 15 Jul 2021 04:17:55 GMT
 - Vary: Accept-Encoding
- Entity:**
 - Content-Length: 4400
 - Content-Type: application/x-mpegURL

Packet Captured by Fiddler tool

| Headers | TextView | SyntaxView | WebForms | HexView | Auth | Cookies | Raw | JSON | XML | | | |
|---|----------|------------|------------|-----------|---------|---------|------|---------|---------|-----|------|-----|
| Request Headers [Raw] [Header Definitions] GET /vod/p/ <u>master.m3u8</u> ?encp=FZUTWdlRPOCbFQ29evfVww:pY6l5k6P5FQzr0xl60F1EbuNs6_kbFsVBMnGcSSWP79J-OebtWgVr9CA3J65wsaxUs1pYEWY8l6SYDRscxPm | | | | | | | | | | | | |
| Client Accept: */* Accept-Encoding: gzip, deflate, br Accept-Language: en-US,en;q=0.9 User-Agent: Mozilla/5.0 (Windows NT 6.1; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/91.0.4472.124 Safari/537.36 | | | | | | | | | | | | |
| Miscellaneous Referer: <u>https://www.nfl.com/</u> | | | | | | | | | | | | |
| Security Origin: https://www.nfl.com sec-ch-ua: "Not;A Brand";v="99", "Google Chrome";v="91", "Chromium";v="91" sec-ch-ua-mobile: ?0 | | | | | | | | | | | | |
| Transformer | Headers | TextView | SyntaxView | ImageView | HexView | WebView | Auth | Caching | Cookies | Raw | JSON | XML |
| <pre>{ "session_id": "1177471499-n91f2d446-9e01-448b-a085-4ea04cb8c83d", "master_m3u8": "https://dcs-vod.apis.anvato.net/vod/vp/session/master.m3u8?i=1177471499-n91f2d446-9e01-448b-a085-4ea04cb8c83d&anvtrid=w5741a7f3ae79f3c1fe4d8caa/29b689", "interstitials": { "cues": [], "content": { "output_duration": 69.036 }, "breaks": [], "info": {} } }</pre> | | | | | | | | | | | | |

Packet Captured by Fiddler tool

| # | Result | Protocol | Host | URL | Content-Type |
|-----|--------|----------|-------------------------|-------------------------------|-------------------------|
| 135 | 200 | HTTP | Tunnel to | apv-static.minute.ly:443 | |
| 136 | 304 | HTTPS | access-prod.apis.a... | /anvads/GXvEgwyJeWe... | |
| 137 | 206 | HTTPS | apv-static.minute.ly | /videos/v-7174b7e0-b125... | video/mp4 |
| 138 | 200 | HTTP | Tunnel to | tlx.apis.anvato.net:443 | |
| 139 | 200 | HTTP | Tunnel to | apv-static.minute.ly:443 | |
| 140 | 200 | HTTPS | tlx.apis.anvato.net | /rest/v2/server_time?anv... | application/json |
| 141 | 200 | HTTPS | tlx.apis.anvato.net | /rest/v2/mcp/video/94445... | application/x-javasc... |
| 142 | 200 | HTTP | Tunnel to | dcs-vod.apis.anvato.net... | |
| 143 | 206 | HTTPS | apv-static.minute.ly | /videos/v-7174b7e0-b125... | video/mp4 |
| 144 | 200 | HTTPS | dcs-vod.apis.anvat... | /vod/p/master.m3u8?enc... | application/json |
| 145 | 206 | HTTPS | apv-static.minute.ly | /videos/v-7174b7e0-b125... | video/mp4 |
| 146 | 304 | HTTPS | www.nfl.com | /compiledassets/assets/fo... | |
| 147 | 200 | HTTP | Tunnel to | p.nfltags.com:443 | |
| 148 | 206 | HTTPS | apv-static.minute.ly | /videos/v-7174b7e0-b125... | video/mp4 |
| 149 | 206 | HTTPS | p.nfltags.com | /nfl/fonts/cons/NFLIcons... | application/font-woff |
| 150 | 200 | HTTP | Tunnel to | content-autofill.googleapi... | |
| 151 | 206 | HTTPS | p.nfltags.com | /nfl/fonts/cons/NFLIcons... | application/font-woff |
| 152 | 200 | HTTPS | content-autofill.goo... | /v1/pages/ChRDahJvbW... | text/plain |
| 153 | 200 | HTTP | Tunnel to | dcs-vod.apis.anvato.net... | |
| 154 | 200 | HTTPS | dcs-vod.apis.anvat... | /vod/p/session/master.m3... | application/x-mpeg... |
| 155 | 200 | HTTP | Tunnel to | player-health.apis.anvato... | |
| 156 | 200 | HTTP | Tunnel to | player-health.apis.anvato... | |
| 157 | 200 | HTTP | Tunnel to | dpm.demdex.net:443 | |
| 158 | 200 | HTTP | Tunnel to | nfl.hb.omtrdc.net:443 | |
| 159 | 200 | HTTPS | dcs-vod.apis.anvat... | /vod/p/355400/prog.m3u... | application/x-mpeg... |
| 160 | 200 | HTTP | Tunnel to | au5e6f8g7ryz8sqdsuw3dc... | |

Log
Filters
Timeline
Get Started
Statistics
Inspectors
AutoResponder
Composer
Fiddler Orchestra Beta
FiddlerScript

Request Headers
[Raw] [Header Definitions]
GET /vod/p/session/master.m3u8?w=177471459n91f2d446-9e01-448b-a085-4ea04cb8c83d&anvtrid=w5741a7f3ae73c1fe4d8caa723b689 HTTP/1.1
Client
Accept: */*
Accept-Encoding: gzip, deflate, br
Accept-Language: en-US,en;q=0.9
User-Agent: Mozilla/5.0 (Windows NT 6.1; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/91.0.4472.124 Safari/537.36
Miscellaneous
Referer: https://www.nfl.com/
Security
Origin: https://www.nfl.com
sec-ch-ua: "Not;A Brand";v="99", "Google Chrome";v="91", "Chromium";v="91"
sec-ch-ua-mobile: ?0

Response Headers
[Raw] [Header Definitions]
HTTP/1.1 200 OK
Cache
Cache-Control: max-age=0, no-cache, no-store
Date: Thu, 15 Jul 2021 04:17:55 GMT
Vary: Accept-Encoding
Entity
Content-Length: 4400
Content-Type: application/x-mpegURL

| No. | Time | Method | Host | URI | Content-Type |
|-----|------|--------|-------------------------|-------------------------------|--------------|
| 143 | 206 | HTTPS | apv-static.minute.ly | /videos/v-7174b7e0-b125... | video/mp4 |
| 144 | 200 | HTTPS | dcs-vod.apis.anvato.net | /vod/p/master.m3u8?enc... | application |
| 145 | 206 | HTTPS | apv-static.minute.ly | /videos/v-7174b7e0-b125... | video/mp4 |
| 146 | 304 | HTTPS | www.nfi.com | /compiledassets/assets/fo... | |
| 147 | 200 | HTTP | Tunnel to | p.nftags.com:443 | |
| 148 | 206 | HTTPS | apv-static.minute.ly | /videos/v-7174b7e0-b125... | video/mp4 |
| 149 | 206 | HTTPS | p.nftags.com | /nfi/fonts/icons/NFIIcons... | application |
| 150 | 200 | HTTP | Tunnel to | content-autofill.googleapi... | |
| 151 | 206 | HTTPS | p.nftags.com | /nfi/fonts/icons/NFIIcons... | application |
| 152 | 200 | HTTPS | content-autofill.goo... | /v1/pages/ChRDahJvBW... | text/plain |
| 153 | 200 | HTTP | Tunnel to | dcs-vod.apis.anvato.net:... | |
| 154 | 200 | HTTPS | dcs-vod.apis.anvato.net | /vod/p/session/master.m3u... | application |
| 155 | 200 | HTTP | Tunnel to | player-health.apis.anvato... | |
| 156 | 200 | HTTP | Tunnel to | player-health.apis.anvato... | |
| 157 | 200 | HTTP | Tunnel to | dpm.demdex.net:443 | |
| 158 | 200 | HTTP | Tunnel to | nfi.hb.omtrdc.net:443 | |
| 159 | 200 | HTTPS | dcs-vod.apis.anvato.net | /vod/p/355400/prog.m3u... | application |
| 160 | 200 | HTTP | Tunnel to | au5e6f8g7y28sqdsuw3dc... | |
| 161 | 200 | HTTP | Tunnel to | ad16a8c8b860d62e9d55b... | |
| 162 | 200 | HTTPS | player-health.apis... | /pixel.png?player_type=... | image/png |
| 163 | 200 | HTTPS | player-health.apis... | /pixel.png?player_type=... | image/png |
| 164 | 200 | HTTPS | dpm.demdex.net | /ld?id_rtb=json&d_ver=2... | application |
| 165 | 200 | HTTP | Tunnel to | gpiacfw3gtfw4vmh5nc4u... | |
| 166 | 200 | HTTPS | nfi.hb.omtrdc.net | /settings/f75c3025512d2c... | application |
| 167 | 200 | HTTP | Tunnel to | r7c2k6b3.ssl.hwcdn.net:443 | |
| 168 | 200 | HTTP | Tunnel to | gpiacfw3gtfw4vmh5nc4u... | |
| 169 | 200 | HTTP | Tunnel to | gpiacfw3gtfw4vmh5nc4u... | |
| 170 | 200 | HTTP | Tunnel to | gpiacfw3gtfw4vmh5nc4u... | |
| 171 | 200 | HTTP | Tunnel to | gpiacfw3gtfw4vmh5nc4u... | |
| 172 | 200 | HTTP | Tunnel to | gpiacfw3gtfw4vmh5nc4u... | |
| 173 | 200 | HTTPS | ad16a8c8b860d62e... | /0/wsg | application |
| 174 | 200 | HTTP | Tunnel to | storage.googleapis.com:443 | |

Request Headers

GET /vod/p/session/master.m3u8?i=177471499-n91f2d446-9e01-448b-a085-4ea04cb8c83d&anvtrid=w5741a73ee79f3c1fe4d8caa729b689 HTTP/1.1

Client

Accept: */*

Accept-Encoding: gzip, deflate, br

Accept-Language: en-US,en;q=0.9

User-Agent: Mozilla/5.0 (Windows NT 6.1; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/91.0.4472.124 Safari/537.36

Miscellaneous

Referer: https://www.nfi.com/

Security

Origin: https://www.nfi.com

sec-ch-ua: "Not;A Brand";v="99", "Google Chrome";v="91", "Chromium";v="91"

sec-ch-ua-mobile: ?0

Transformer Headers TextView SyntaxView ImageView HexView WebView Auth Caching Cookies Raw JSON XML

#EXTM3U

#EXT-X-INDEPENDENT-SEGMENTS

#EXT-X-STREAM-INF: BANDWIDTH=355400, FRAME-RATE=30, RESOLUTION=416x234, AVERAGE-BANDWIDTH=308000, CODECS="mp4a.40.2, avc1.42

https://dcs-vod.apis.anvato.net/vod/p/355400/prog.m3u8?i=177471499-n91f2d446-9e01-448b-a085-4ea04cb8c83d&anvtrid=w5741

#EXT-X-STREAM-INF: BANDWIDTH=502400, FRAME-RATE=30, RESOLUTION=416x234, AVERAGE-BANDWIDTH=448000, CODECS="mp4a.40.2, avc1.42

https://dcs-vod.apis.anvato.net/vod/p/502400/prog.m3u8?i=177471499-n91f2d446-9e01-448b-a085-4ea04cb8c83d&anvtrid=w5741

#EXT-X-STREAM-INF: BANDWIDTH=691400, FRAME-RATE=30, RESOLUTION=640x360, AVERAGE-BANDWIDTH=628000, CODECS="mp4a.40.2, avc1.42

https://dcs-vod.apis.anvato.net/vod/p/691400/prog.m3u8?i=177471499-n91f2d446-9e01-448b-a085-4ea04cb8c83d&anvtrid=w5741

#EXT-X-STREAM-INF: BANDWIDTH=1006400, FRAME-RATE=30, RESOLUTION=640x360, AVERAGE-BANDWIDTH=928000, CODECS="mp4a.40.2, avc1.4

https://dcs-vod.apis.anvato.net/vod/p/1006400/prog.m3u8?i=177471499-n91f2d446-9e01-448b-a085-4ea04cb8c83d&anvtrid=w5741

#EXT-X-STREAM-INF: BANDWIDTH=1426400, FRAME-RATE=30, RESOLUTION=768x432, AVERAGE-BANDWIDTH=1328000, CODECS="mp4a.40.2, avc1.

https://dcs-vod.apis.anvato.net/vod/p/1426400/prog.m3u8?i=177471499-n91f2d446-9e01-448b-a085-4ea04cb8c83d&anvtrid=w5741

#EXT-X-STREAM-INF: BANDWIDTH=2266400, FRAME-RATE=30, RESOLUTION=768x432, AVERAGE-BANDWIDTH=2128000, CODECS="mp4a.40.2, avc1.

https://dcs-vod.apis.anvato.net/vod/p/2266400/prog.m3u8?i=177471499-n91f2d446-9e01-448b-a085-4ea04cb8c83d&anvtrid=w5741

#EXT-X-STREAM-INF: BANDWIDTH=3526400, FRAME-RATE=30, RESOLUTION=1280x720, AVERAGE-BANDWIDTH=3328000, CODECS="mp4a.40.2, avc1

https://dcs-vod.apis.anvato.net/vod/p/3526400/prog.m3u8?i=177471499-n91f2d446-9e01-448b-a085-4ea04cb8c83d&anvtrid=w5741

#EXT-X-STREAM-INF: BANDWIDTH=5416400, FRAME-RATE=30, RESOLUTION=1280x720, AVERAGE-BANDWIDTH=5128000, CODECS="mp4a.40.2, avc1

https://dcs-vod.apis.anvato.net/vod/p/5416400/prog.m3u8?i=177471499-n91f2d446-9e01-448b-a085-4ea04cb8c83d&anvtrid=w5741

#EXT-X-STREAM-INF: BANDWIDTH=8566400, FRAME-RATE=30, RESOLUTION=1920x1080, AVERAGE-BANDWIDTH=8128000, CODECS="mp4a.40.2, avc

https://dcs-vod.apis.anvato.net/vod/p/8566400/prog.m3u8?i=177471499-n91f2d446-9e01-448b-a085-4ea04cb8c83d&anvtrid=w5741

#EXT-X-T-STREAM-INF: BANDWIDTH=308000, RESOLUTION=416x234, CODECS="avc1.42000d, mp4a.40.2", URI="https://dcs-vod.apis

#EXT-X-I-FRAME-STREAM-INF: BANDWIDTH=448000, RESOLUTION=416x234, CODECS="avc1.42000d, mp4a.40.2", URI="https://dcs-vod.apis

#EXT-X-I-FRAME-STREAM-INF: BANDWIDTH=628000, RESOLUTION=640x360, CODECS="avc1.42001e, mp4a.40.2", URI="https://dcs-vod.apis

#EXT-X-I-FRAME-STREAM-INF: BANDWIDTH=928000, RESOLUTION=640x360, CODECS="avc1.4d001e, mp4a.40.2", URI="https://dcs-vod.apis

#EXT-X-I-FRAME-STREAM-INF: BANDWIDTH=1328000, RESOLUTION=768x432, CODECS="avc1.4d001e, mp4a.40.2", URI="https://dcs-vod.apis

#EXT-X-T-FRAME-STREAM-INF: BANDWIDTH=2128000, RESOLUTION=768x432, CODECS="avc1.4d001e, mp4a.40.2", URI="https://dcs-vod.apis

Packet Captured by Fiddler tool

| | | | | | |
|-----|-----|-------|-------------------------|-------------------------------|-------------|
| 143 | 200 | HTTPS | apv-static.minutely.ly | /videos/v-7174b7e0-b125... | video/mp4 |
| 144 | 200 | HTTPS | dcs-vod.apis.anvat... | /vod/p/master.m3u8?enc... | application |
| 145 | 206 | HTTPS | apv-static.minutely.ly | /videos/v-7174b7e0-b125... | video/mp4 |
| 146 | 304 | HTTPS | www.nfl.com | /compiledassets/assets/fo... | |
| 147 | 200 | HTTP | Tunnel to | p.nfltags.com:443 | |
| 148 | 206 | HTTPS | apv-static.minutely.ly | /videos/v-7174b7e0-b125... | video/mp4 |
| 149 | 206 | HTTPS | p.nfltags.com | /nfl/fonts/icons/NFLIcons... | application |
| 150 | 200 | HTTP | Tunnel to | content-autofill.googleapi... | |
| 151 | 206 | HTTPS | p.nfltags.com | /nfl/fonts/icons/NFLIcons... | application |
| 152 | 200 | HTTPS | content-autofill.goo... | /v1/pages/CHRDaHjvbW... | text/plain |
| 153 | 200 | HTTP | Tunnel to | dcs-vod.apis.anvato.net: | |
| 154 | 200 | HTTPS | dcs-vod.apis.anvat... | /vod/p/session/master.m3... | application |
| 155 | 200 | HTTP | Tunnel to | player-health.apis.anvato... | |
| 156 | 200 | HTTP | Tunnel to | player-health.apis.anvato... | |
| 157 | 200 | HTTP | Tunnel to | dpm.demdex.net:443 | |
| 158 | 200 | HTTP | Tunnel to | nfl.hb.omtrdc.net:443 | |
| 159 | 200 | HTTPS | dcs-vod.apis.anvat... | /vod/p/355400/prog_m3u... | application |
| 160 | 200 | HTTP | Tunnel to | au5e6f8g7ryz8sqdsuw3dc... | |
| 161 | 200 | HTTP | Tunnel to | ad16a8c8b86d62e9d55b... | |
| 162 | 200 | HTTPS | player-health.apis.... | /pixel.png?player_type=... | image/png |
| 163 | 200 | HTTPS | player-health.apis.... | /pixel.png?player_type=... | image/png |
| 164 | 200 | HTTPS | dpm.demdex.net | /ld7d_rtbid=json&d_ver=2... | application |
| 165 | 200 | HTTP | Tunnel to | gpizachw3gtfw4vmh5nc4u... | |
| 166 | 200 | HTTPS | nfl.hb.omtrdc.net | /settings/7F5c3025512d2c... | application |
| 167 | 200 | HTTP | Tunnel to | r7c2k6b3.ssl.hwcdn.net:443 | |
| 168 | 200 | HTTP | Tunnel to | gpizachw3gtfw4vmh5nc4u... | |
| 169 | 200 | HTTP | Tunnel to | gpizachw3gtfw4vmh5nc4u... | |
| 170 | 200 | HTTP | Tunnel to | gpizachw3gtfw4vmh5nc4u... | |
| 171 | 200 | HTTP | Tunnel to | gpizachw3gtfw4vmh5nc4u... | |
| 172 | 200 | HTTP | Tunnel to | gpizachw3gtfw4vmh5nc4u... | |
| 173 | 200 | HTTPS | ad16a8c8b86d62e... | /0/wsg | application |
| 174 | 200 | HTTP | Tunnel to | storage.googleapis.com:443 | |

Request Headers

GET /vod/p/355400/prog_m3u8?i=177471499-n91f2d446-9e01-448b-a085-4ea04cb8c83d&anvrid=w5741a73ae79f3c1fe4d8caa729b689 HTTP/1.1

Client

Accept: */*

Accept-Encoding: gzip, deflate, br

Accept-Language: en-US,en;q=0.9

User-Agent: Mozilla/5.0 (Windows NT 6.1; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/91.0.4472.124 Safari/537.36

Miscellaneous

Referer: https://www.nfl.com/

Security

Origin: https://www.nfl.com

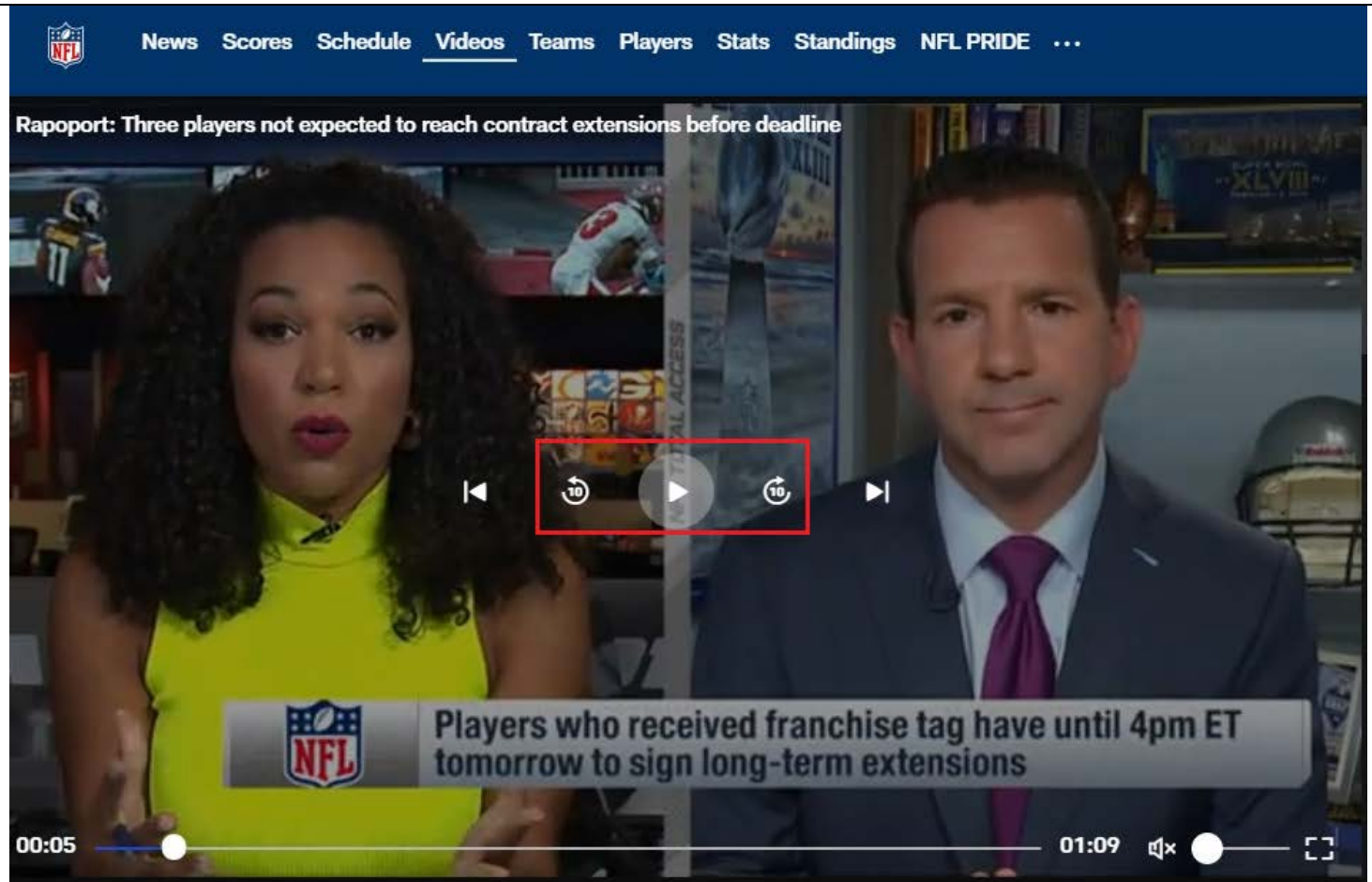
sec-ch-ua: "NotA Brand";v="99", "Google Chrome";v="91", "Chromium";v="91"

sec-ch-ua-mobile: ?0

| Transformer | Headers | TextView | SyntaxView | ImageView | HexView | WebView | Auth | Caching | Cookies | Raw | JSON | XML | |
|-------------|-------------------|---------------------------|---------------------------|------------------------------|-----------------------------------|-----------------|---|-----------------------------------|-----------------|---|-----------------------------------|-----------------|---|
| #EXTM3U | #EXT-X-VERSION: 3 | #EXT-X-TARGETDURATION: 10 | #EXT-X-PLAYLIST-TYPE: VOD | #ANVATO-CDN-PROVIDER: level3 | #ANVATO-SEGMENT-INFO: type=master | #EXTINF: 9.009, | https://au5e6f8g7ryz8sqdsuw3dcdapdf.ct1.nfl.com/leaque/5684/21/07/14/944452/EBF32C3EB185DAC767B7A44F894861986A95AE75856 | #ANVATO-SEGMENT-INFO: type=master | #EXTINF: 9.009, | https://au5e6f8g7ryz8sqdsuw3dcdapdf.ct1.nfl.com/leaque/5684/21/07/14/944452/EBF32C3EB185DAC767B7A44F894861986A95AE75856 | #ANVATO-SEGMENT-INFO: type=master | #EXTINF: 9.009, | https://au5e6f8g7ryz8sqdsuw3dcdapdf.ct1.nfl.com/leaque/5684/21/07/14/944452/EBF32C3EB185DAC767B7A44F894861986A95AE75856 |

Packet Captured by Fiddler tool

NFL.com streams videos with the capability of being played with trick mode (e.g., 10 Second reverse/forward trick mode)



<https://www.nfl.com/videos/>

NFL.com streams encrypted content making use of AES 128 bit encryption.

An encryption method of AES-128 signals that Media Segments are completely encrypted using the Advanced Encryption Standard (AES) [AES_128] with a 128-bit key, Cipher Block Chaining (CBC), and Public-Key Cryptography Standards #7 (PKCS7) padding [RFC5652]. CBC is restarted on each segment boundary, using either the Initialization Vector (IV) attribute value or the Media Sequence Number as the IV; see [Section 5.2](#).

An encryption method of SAMPLE-AES means that the Media Segments contain media samples, such as audio or video, that are encrypted using the Advanced Encryption Standard [AES_128]. How these media streams are encrypted and encapsulated in a segment depends on the

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media encoding and the media format of the segment. fMP4 Media Segments are encrypted using the 'cbcs' scheme of Common Encryption [COMMON_ENC]. Encryption of other Media Segment formats containing H.264 [H_264], AAC [ISO_14496], AC-3 [AC_3], and Enhanced AC-3 [AC_3] media streams is described in the HTTP Live Streaming (HLS) Sample Encryption specification [SampleEnc]. The IV attribute MAY be present; see [Section 5.2](#).

<https://tools.ietf.org/html/rfc8216>

| # | Result | Protocol | Host | URL | Content-Type |
|----|--------|----------|-----------------------|-------------------------------|-------------------------|
| 47 | 200 | HTTPS | smetrics.nfl.com | /b/ss/nflglobal/2016/10/35... | application/x-javasc... |
| 48 | 304 | HTTPS | www.nfl.com | /compiledassets/js/92426... | |
| 49 | 200 | HTTP | Tunnel to | www.nfl.com:443 | |
| 50 | 304 | HTTPS | www.nfl.com | /compiledassets/js/92426... | |
| 51 | 200 | HTTP | Tunnel to | www.nfl.com:443 | |
| 52 | 200 | HTTPS | www.google.com | /pagead/1p-user-list/9214... | image/gif |
| 53 | 200 | HTTP | Tunnel to | www.google.co.in:443 | |
| 54 | 200 | HTTP | Tunnel to | www.nfl.com:443 | |
| 55 | 304 | HTTPS | www.nfl.com | /compiledassets/js/92426... | |
| 56 | 304 | HTTPS | www.nfl.com | /compiledassets/js/92426... | |
| 57 | 302 | HTTPS | googleads.g.double... | /pagead/viewthroughcon... | image/gif |
| 58 | 304 | HTTPS | www.nfl.com | /compiledassets/js/92426... | |
| 59 | 304 | HTTPS | www.nfl.com | /compiledassets/js/92426... | |
| 60 | 200 | HTTP | Tunnel to | auth-id.nfl.com:443 | |
| 61 | 304 | HTTPS | www.nfl.com | /compiledassets/js/92426... | |
| 62 | 304 | HTTPS | www.nfl.com | /compiledassets/js/92426... | |
| 63 | 200 | HTTP | Tunnel to | www.facebook.com:443 | |
| 64 | 304 | HTTPS | www.nfl.com | /compiledassets/js/92426... | |
| 65 | 200 | HTTP | Tunnel to | www.nfl.com:443 | |
| 66 | 302 | HTTPS | www.google.com | /pagead/1p-user-list/8455... | image/gif |
| 67 | 302 | HTTPS | googleads.g.double... | /pagead/viewthroughcon... | image/gif |
| 68 | 304 | HTTPS | www.nfl.com | /compiledassets/js/92426... | |
| 69 | 304 | HTTPS | www.nfl.com | /compiledassets/js/92426... | |
| 70 | 304 | HTTPS | www.nfl.com | /compiledassets/js/92426... | |
| 71 | 304 | HTTPS | www.nfl.com | /compiledassets/js/92426... | |
| 72 | 304 | HTTPS | www.nfl.com | /compiledassets/js/92426... | |
| 73 | 304 | HTTPS | www.nfl.com | /compiledassets/js/92426... | |
| 74 | 200 | HTTP | Tunnel to | googleads.g.doubleclick.n... | |

Log

Get Started | Statistics | Inspectors | AutoResponder | Composer | Fiddler Orchestra Be

Headers | TextView | SyntaxView | WebForms | HexView | Auth | Cookies | Raw | JSON | XML

A SSLv3-compatible ClientHello handshake was found. Fiddler extracted the parameters below.

Version: 3.3 (TLS/1.2)
Random: 02 90 AA BF 2C FA 99 9F 59 81 A3 DD 63 ED 72 CD 3F ED 49 A6 63 06 2E DC 2E AC 39 B2 B1 79 C8 F5
Time: 25-11-2071 03:00:42
SessionID: 5D 3A 00 00 37 05 C1 02 7E 3A 8E 94 89 26 8D 56 9A 69 91 31 4C 39 B7 D7 43 54 AB A2 7A 3D 2B AF
Extensions:
 grease (0x2a2a) empty
 server_name www.nfl.com
 extended_master_secret empty
 renegotiation_info 00
 supported_groups grease [0x3a3a], x25519 [0x1d], secp256r1 [0x17], secp384r1 [0x18]
 ec_point_formats uncompressed [0x0]
 SessionTicket empty
 ATPN h? hfm/1 1

0:0 0/1,972 Find... (press Ctrl+Enter to highlight all)

Transformer | Headers | TextView | SyntaxView | ImageView | HexView | WebView | Auth | Caching | Cookies

Encrypted HTTPS flows through this CONNECT tunnel. HTTPS Decryption is enabled in Fiddler, so decrypted sessions running in this the Web Sessions list.

Secure Protocol: TLS12
Cipher: Aes128 128bits
Hash Algorithm: SHA256 256bits
Key Exchange: ECDHE_RSA (0xae06) 256bits

== Server Certificate ==
[Subject]
CN=clubswb.san1.nfl.com

[Issuer]
CN=R3, O=Let's Encrypt, C=US

Packet Captured by Fiddler Tool

1. Introduction to HTTP Live Streaming

HTTP Live Streaming provides a reliable, cost-effective means of delivering continuous and long-form video over the Internet. It allows a receiver to adapt the bit rate of the media to the current network conditions in order to maintain uninterrupted playback at the best possible quality. It supports interstitial content boundaries. It provides a flexible framework for media encryption. It can efficiently offer multiple renditions of the same content, such as audio translations. It offers compatibility with large-scale HTTP caching infrastructure to support delivery to large audiences.

Since the Internet-Draft was first posted in 2009, HTTP Live Streaming has been implemented and deployed by a wide array of content producers, tools vendors, distributors, and device manufacturers. In the subsequent eight years, the protocol has been refined by extensive review and discussion with a variety of media streaming implementors.

The purpose of this document is to facilitate interoperability between HTTP Live Streaming implementations by describing the media transmission protocol. Using this protocol, a client can receive a continuous stream of media from a server for concurrent presentation.

<https://tools.ietf.org/html/rfc8216>

The first line is the format identifier tag #EXTM3U. The line containing #EXT-X-TARGETDURATION says that all Media Segments will be 10 seconds long or less. Then, three Media Segments are declared. The first and second are 9.009 seconds long; the third is 3.003 seconds.

To play this Playlist, the client first downloads it and then downloads and plays each Media Segment declared within it. The client reloads the Playlist as described in this document to discover any added segments. Data SHOULD be carried over HTTP [RFC7230], but, in general, a URI can specify any protocol that can reliably transfer the specified resource on demand.

<https://tools.ietf.org/html/rfc8216>

Playlist files contain URIs, which clients will use to make network requests of arbitrary entities. Clients SHOULD range-check responses to prevent buffer overflows. See also the Security Considerations section of "Uniform Resource Identifier (URI): Generic Syntax" [RFC3986].

<https://tools.ietf.org/html/rfc8216>

An encryption method of AES-128 signals that Media Segments are completely encrypted using the Advanced Encryption Standard (AES) [AES_128] with a 128-bit key, Cipher Block Chaining (CBC), and Public-Key Cryptography Standards #7 (PKCS7) padding [RFC5652]. CBC is restarted on each segment boundary, using either the Initialization Vector (IV) attribute value or the Media Sequence Number as the IV; see [Section 5.2](#).

An encryption method of SAMPLE-AES means that the Media Segments contain media samples, such as audio or video, that are encrypted using the Advanced Encryption Standard [AES_128]. How these media streams are encrypted and encapsulated in a segment depends on the

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media encoding and the media format of the segment. fMP4 Media Segments are encrypted using the 'cbcs' scheme of Common Encryption [COMMON_ENC]. Encryption of other Media Segment formats containing H.264 [H_264], AAC [ISO_14496], AC-3 [AC_3], and Enhanced AC-3 [AC_3] media streams is described in the HTTP Live Streaming (HLS) Sample Encryption specification [SampleEnc]. The IV attribute MAY be present; see [Section 5.2](#).

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5. Key Files

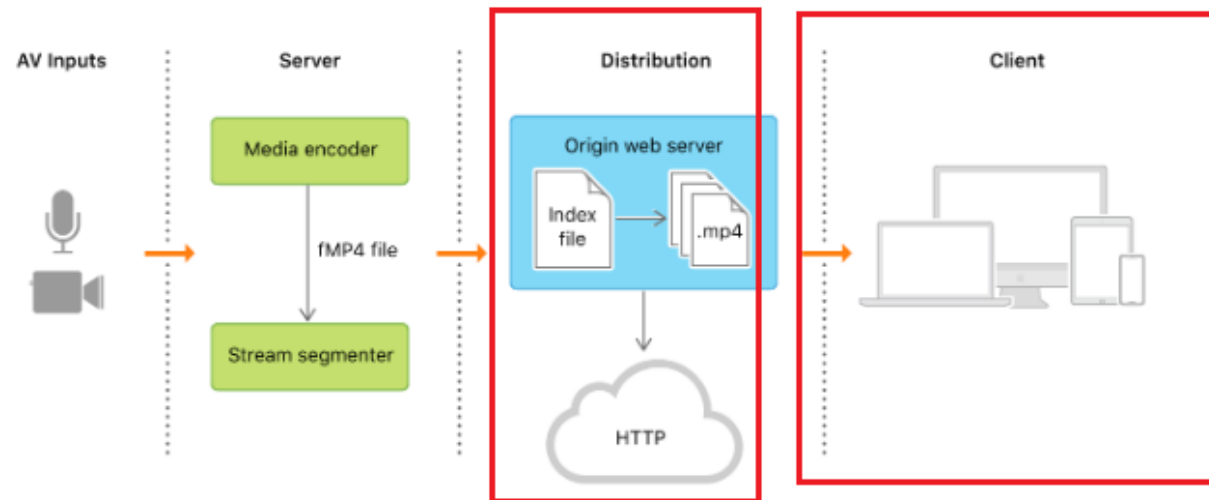
5.1. Structure of Key Files

An EXT-X-KEY tag with a URI attribute identifies a Key file. A Key file contains a cipher key that can decrypt Media Segments in the Playlist.

[AES_128] encryption uses 16-octet keys. If the KEYFORMAT of an EXT-X-KEY tag is "identity", the Key file is a single packed array of 16 octets in binary format.

<https://tools.ietf.org/html/rfc8216>

The following figure shows the components of an HTTP Live Stream.



Apple provides several frameworks that support HTTP Live Streaming, including [AVKit](#), [AVFoundation](#), and [WebKit](#).

https://developer.apple.com/documentation/http_live_streaming

| | |
|--|---|
| | <p>Latency is cumulative, hence it is added along the whole delivery path from transcoding to the client through the CDN (packaging/origin and caching). Yet, as of today, most of the latency comes from the client: <u>Due to the operation of the protocol (HLS or DASH), and the request/response cycles necessary to obtain the media segments, clients have to maintain a large enough buffer to ensure smooth playback. As an example, an Apple HLS client will start playback once it has buffered at least two segments, resulting in observed latency ranging from 5 to 18 seconds depending on segment durations (2 to 6 seconds).</u></p> <p>To address these issues, both standards have proposed low-latency extensions altering the delivery to the client so that the client can reduce the size of its buffers its buffer sizes:</p> <ul style="list-style-type: none"> ✓ On one side, DASH has built a proposal relying on CMAF combined with HTTP/1.1 chunked transfer encoding to limit the latency induced by the packaging step, with minimal changes on the player side. <p>https://broadpeak.tv/blog/how-apple-hls-is-strengthening-its-hand-in-the-abr-game-with-ll-hls/</p> |
| <p>descrambling of said scrambled data of said stream so as to extract therefrom additional data corresponding to information required by at least one function of the</p> | <p>The Standard practices descrambling (e.g., decrypting the received encrypted video segments) of said scrambled data of said stream (e.g., scrambled video segments) so as to extract therefrom additional data (e.g., information related to the video segments for trick mode) corresponding to information required by a function of the special mode or “trick mode.”</p> <p>As shown below, I-frame playlists are decrypted and extracted which pertain to functions of the trick mode (e.g., time based trick mode)</p> |

| | |
|---|---|
| <p>special mode or “trick mode” (fast forward, fast rewind, accelerated motion, slow motion, etc.); and</p> | <p>If the encryption METHOD is AES-128, AES-128 CBC decryption SHALL be applied to individual Media Segments, whose encryption format is described in Section 4.3.2.4.</p> <p>If the encryption METHOD is AES-128 and the Media Segment is part of an I-frame Playlist (Section 4.3.3.6) and it has an EXT-X-BYTERANGE tag applied to it, special care needs to be taken in loading and decrypting the segment, because the resource identified by the URI is encrypted in 16-byte blocks from the start of the resource.</p> <p>The decrypted I frame can be recovered by first widening its byte range, as specified by the EXT-X-BYTERANGE tag, so that it starts and ends on 16-byte boundaries from the start of the resource.</p> <p>Next, the byte range is widened further to include a 16-byte block at the beginning of the range. This 16-byte block allows the correct IV for the following block to be calculated.</p> <p>The widened byte range can then be loaded and decrypted with AES-128 CBC using an arbitrary IV. The number of bytes added to the beginning and the end of the original byte range are discarded from the decrypted bytes; what remains is the decrypted I-frame.</p> <p>If the encryption METHOD is SAMPLE-AES, AES-128 decryption SHALL be applied to encrypted media samples within the Media Segment.</p> <p>An EXT-X-KEY tag with a METHOD of NONE indicates that the Media Segments it applies to are not encrypted.</p> <p>https://tools.ietf.org/html/rfc8216</p> |
|---|---|

6.3.6. Decrypting Encrypted Media Segments

If a Media Playlist file contains an EXT-X-KEY tag that specifies a Key file URI, the client can obtain that Key file and use the key inside it to decrypt all Media Segments to which that EXT-X-KEY tag applies.

<https://tools.ietf.org/html/rfc8216>

8.5. Master Playlist with I-Frames

```
#EXTM3U
#EXT-X-STREAM-INF:BANDWIDTH=1280000
low/audio-video.m3u8
#EXT-X-I-FRAME-STREAM-INF:BANDWIDTH=86000,URI="low/iframe.m3u8"
#EXT-X-STREAM-INF:BANDWIDTH=2560000
mid/audio-video.m3u8
#EXT-X-I-FRAME-STREAM-INF:BANDWIDTH=150000,URI="mid/iframe.m3u8"
#EXT-X-STREAM-INF:BANDWIDTH=7680000
hi/audio-video.m3u8
#EXT-X-I-FRAME-STREAM-INF:BANDWIDTH=550000,URI="hi/iframe.m3u8"
#EXT-X-STREAM-INF:BANDWIDTH=65000,CODECS="mp4a.40.5"
audio-only.m3u8
```

<https://tools.ietf.org/html/rfc8216>


```
#EXT-X-I-FRAME-STREAM-INF:BANDWIDTH=308000,RESOLUTION=416x234,CODECS="avc1.42000d, mp4a.40.2",URI="https://dcs-
vod.apis.anvato.net/vod/p/308000/iframes.m3u8?i=177471499-n91f2d446-9e01-448b-a085-4ea04cb8c83d"
#EXT-X-I-FRAME-STREAM-INF:BANDWIDTH=448000,RESOLUTION=416x234,CODECS="avc1.42000d, mp4a.40.2",URI="https://dcs-
vod.apis.anvato.net/vod/p/448000/iframes.m3u8?i=177471499-n91f2d446-9e01-448b-a085-4ea04cb8c83d"
#EXT-X-I-FRAME-STREAM-INF:BANDWIDTH=628000,RESOLUTION=640x360,CODECS="avc1.42001e, mp4a.40.2",URI="https://dcs-
vod.apis.anvato.net/vod/p/628000/iframes.m3u8?i=177471499-n91f2d446-9e01-448b-a085-4ea04cb8c83d"
#EXT-X-I-FRAME-STREAM-INF:BANDWIDTH=928000,RESOLUTION=640x360,CODECS="avc1.4d001e, mp4a.40.2",URI="https://dcs-
vod.apis.anvato.net/vod/p/928000/iframes.m3u8?i=177471499-n91f2d446-9e01-448b-a085-4ea04cb8c83d"
#EXT-X-I-FRAME-STREAM-INF:BANDWIDTH=1328000,RESOLUTION=768x432,CODECS="avc1.4d001e, mp4a.40.2",URI="https://dcs-
vod.apis.anvato.net/vod/p/1328000/iframes.m3u8?i=177471499-n91f2d446-9e01-448b-a085-4ea04cb8c83d"
#EXT-X-I-FRAME-STREAM-INF:BANDWIDTH=2128000,RESOLUTION=768x432,CODECS="avc1.4d001e, mp4a.40.2",URI="https://dcs-
vod.apis.anvato.net/vod/p/2128000/iframes.m3u8?i=177471499-n91f2d446-9e01-448b-a085-4ea04cb8c83d"
#EXT-X-I-FRAME-STREAM-INF:BANDWIDTH=3328000,RESOLUTION=1280x720,CODECS="avc1.4d001f, mp4a.40.2",URI="https://dcs-
vod.apis.anvato.net/vod/p/3328000/iframes.m3u8?i=177471499-n91f2d446-9e01-448b-a085-4ea04cb8c83d"
#EXT-X-I-FRAME-STREAM-INF:BANDWIDTH=5128000,RESOLUTION=1280x720,CODECS="avc1.4d001f, mp4a.40.2",URI="https://dcs-
vod.apis.anvato.net/vod/p/5128000/iframes.m3u8?i=177471499-n91f2d446-9e01-448b-a085-4ea04cb8c83d"
#EXT-X-I-FRAME-STREAM-INF:BANDWIDTH=8128000,RESOLUTION=1920x1080,CODECS="avc1.4d0028, mp4a.40.2",URI="https://dcs-
vod.apis.anvato.net/vod/p/8128000/iframes.m3u8?i=177471499-n91f2d446-9e01-448b-a085-4ea04cb8c83d"
```

Packet Captured by Fiddler Tool

If the encryption METHOD is AES-128 and the Media Segment is part of an I-frame Playlist ([Section 4.3.3.6](#)) and it has an EXT-X-BYTERANGE tag applied to it, special care needs to be taken in loading and decrypting the segment, because the resource identified by the URI is encrypted in 16-byte blocks from the start of the resource.

The decrypted I-frame can be recovered by first widening its byte range, as specified by the EXT-X-BYTERANGE tag, so that it starts and ends on 16-byte boundaries from the start of the resource.

Next, the byte range is widened further to include a 16-byte block at the beginning of the range. This 16-byte block allows the correct IV for the following block to be calculated.

The widened byte range can then be loaded and decrypted with AES-128 CBC using an arbitrary IV. The number of bytes added to the beginning and the end of the original byte range are discarded from the decrypted bytes; what remains is the decrypted I-frame.

If the encryption METHOD is SAMPLE-AES, AES-128 decryption SHALL be applied to encrypted media samples within the Media Segment.

An EXT-X-KEY tag with a METHOD of NONE indicates that the Media Segments it applies to are not encrypted.

<https://tools.ietf.org/html/rfc8216>

If the encryption METHOD is AES-128 and the Playlist contains an EXT-X-I-FRAMES-ONLY tag, the entire resource MUST be encrypted using AES-128 CBC with PKCS7 padding [RFC5652]. Encryption MAY be restarted on 16-byte block boundaries, unless the first block contains an I-frame. The IV used for encryption MUST be either the Media Sequence Number of the Media Segment or the value of the IV attribute of the EXT-X-KEY tag, as described in [Section 5.2](#). These constraints allow a client to load and decrypt individual I-frames specified as sub-ranges of regular encrypted Media Segments, and their Media Initialization Sections.

<https://tools.ietf.org/html/rfc8216>

| | |
|--|--|
| <p>recording of these additional data on the recording medium.</p> | <p>The product complying with the Standard practices recording of these additional data on the recording medium (e.g., downloading/buffering I-frame information to enable trick play mode rendering).</p> <p>The product must store the data pertaining to trick modes to allow the playback of the video in trick modes.</p> <p>If the encryption METHOD is AES-128, AES-128 CBC decryption SHALL be applied to individual Media Segments, whose encryption format is described in Section 4.3.2.4.</p> <p>If the encryption METHOD is AES-128 and the Media Segment is part of an I-frame Playlist (Section 4.3.3.6) and it has an EXT-X-BYTERANGE tag applied to it, special care needs to be taken in loading and decrypting the segment, because the resource identified by the URI is encrypted in 16-byte blocks from the start of the resource.</p> <p>The decrypted I frame can be recovered by first widening its byte range, as specified by the EXT-X-BYTERANGE tag, so that it starts and ends on 16-byte boundaries from the start of the resource.</p> <p>Next, the byte range is widened further to include a 16-byte block at the beginning of the range. This 16-byte block allows the correct IV for the following block to be calculated.</p> <p>The widened byte range can then be loaded and decrypted with AES-128 CBC using an arbitrary IV. The number of bytes added to the beginning and the end of the original byte range are discarded from the decrypted bytes; what remains is the decrypted I-frame.</p> <p>If the encryption METHOD is SAMPLE-AES, AES-128 decryption SHALL be applied to encrypted media samples within the Media Segment.</p> <p>An EXT-X-KEY tag with a METHOD of NONE indicates that the Media Segments it applies to are not encrypted.</p> <p>https://tools.ietf.org/html/rfc8216</p> |
|--|--|

```
#EXT-X-I-FRAME-STREAM-INF:BANDWIDTH=308000,RESOLUTION=416x234,CODECS="avc1.42000d, mp4a.40.2",URI="https://dcs-
vod.apis.anvato.net/vod/p/308000/iframes.m3u8?i=177471499-n91f2d446-9e01-448b-a085-4ea04cb8c83d"
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vod.apis.anvato.net/vod/p/448000/iframes.m3u8?i=177471499-n91f2d446-9e01-448b-a085-4ea04cb8c83d"
#EXT-X-I-FRAME-STREAM-INF:BANDWIDTH=628000,RESOLUTION=640x360,CODECS="avc1.42001e, mp4a.40.2",URI="https://dcs-
vod.apis.anvato.net/vod/p/628000/iframes.m3u8?i=177471499-n91f2d446-9e01-448b-a085-4ea04cb8c83d"
#EXT-X-I-FRAME-STREAM-INF:BANDWIDTH=928000,RESOLUTION=640x360,CODECS="avc1.4d001e, mp4a.40.2",URI="https://dcs-
vod.apis.anvato.net/vod/p/928000/iframes.m3u8?i=177471499-n91f2d446-9e01-448b-a085-4ea04cb8c83d"
#EXT-X-I-FRAME-STREAM-INF:BANDWIDTH=1328000,RESOLUTION=768x432,CODECS="avc1.4d001e, mp4a.40.2",URI="https://dcs-
vod.apis.anvato.net/vod/p/1328000/iframes.m3u8?i=177471499-n91f2d446-9e01-448b-a085-4ea04cb8c83d"
#EXT-X-I-FRAME-STREAM-INF:BANDWIDTH=2128000,RESOLUTION=768x432,CODECS="avc1.4d001e, mp4a.40.2",URI="https://dcs-
vod.apis.anvato.net/vod/p/2128000/iframes.m3u8?i=177471499-n91f2d446-9e01-448b-a085-4ea04cb8c83d"
#EXT-X-I-FRAME-STREAM-INF:BANDWIDTH=3328000,RESOLUTION=1280x720,CODECS="avc1.4d001f, mp4a.40.2",URI="https://dcs-
vod.apis.anvato.net/vod/p/3328000/iframes.m3u8?i=177471499-n91f2d446-9e01-448b-a085-4ea04cb8c83d"
#EXT-X-I-FRAME-STREAM-INF:BANDWIDTH=5128000,RESOLUTION=1280x720,CODECS="avc1.4d001f, mp4a.40.2",URI="https://dcs-
vod.apis.anvato.net/vod/p/5128000/iframes.m3u8?i=177471499-n91f2d446-9e01-448b-a085-4ea04cb8c83d"
#EXT-X-I-FRAME-STREAM-INF:BANDWIDTH=8128000,RESOLUTION=1920x1080,CODECS="avc1.4d0028, mp4a.40.2",URI="https://dcs-
vod.apis.anvato.net/vod/p/8128000/iframes.m3u8?i=177471499-n91f2d446-9e01-448b-a085-4ea04cb8c83d"
```

Packet Captured by Fiddler Tool

If the encryption METHOD is AES-128 and the Playlist contains an EXT-X-I-FRAMES-ONLY tag, the entire resource MUST be encrypted using AES-128 CBC with PKCS7 padding [RFC5652]. Encryption MAY be restarted on 16-byte block boundaries, unless the first block contains an I-frame. The IV used for encryption MUST be either the Media Sequence Number of the Media Segment or the value of the IV attribute of the EXT-X-KEY tag, as described in Section 5.2. These constraints allow a client to load and decrypt individual I-frames specified as sub-ranges of regular encrypted Media Segments, and their Media Initialization Sections.

<https://tools.ietf.org/html/rfc8216>